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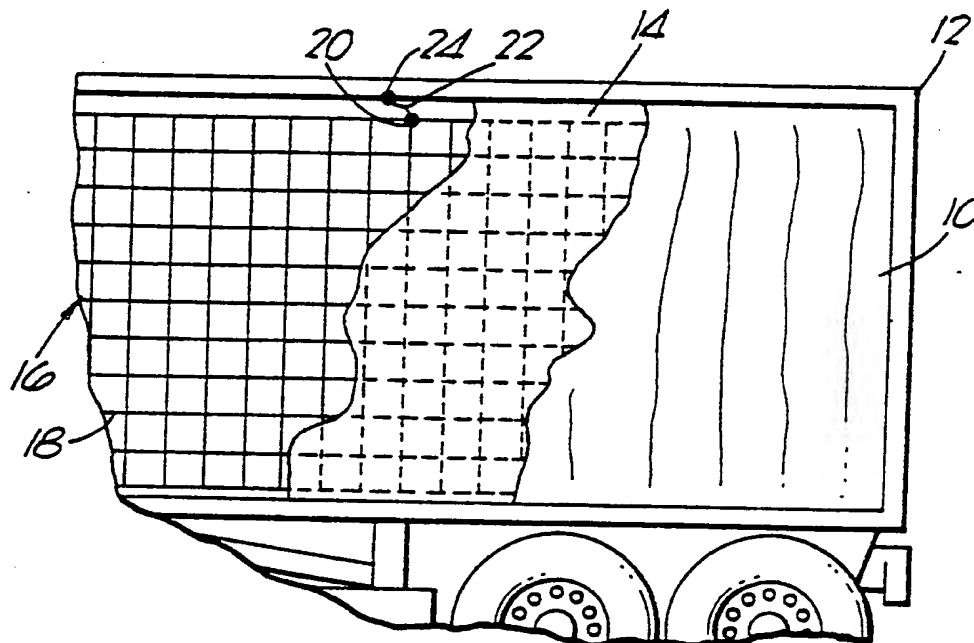
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(54) Title: ALARM SYSTEM



(57) Abstract

An alarm system for protecting an area at least partially enclosed by flexible closure means, such as the load platform of a "curtainsider"-type vehicle, includes sensor means associated with the closure means which are responsive to at least one of the following conditions: disturbance of the closure means; or separation of the closure means from an adjacent member. Preferably the sensor means comprises a network of conductors included with the closure means, together with conductors which connect an edge portion of the closure means to the adjacent member. The conductors may be connected into one or more circuits which may be connected into suitable alarm circuitry by means such as a radio link or an extendable conductor. The alarm is preferably operable in response to breaking a conductor upon attempting to cut or lift the closure means, but it may be responsive to vibration or the making of a circuit.

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ALARM SYSTEM

This invention relates to an alarm system which is particularly suitable for protecting goods which are at least partially enclosed by flexible sheeting and to alarm tape for use in such a system.

5 Commercial vehicles commonly employ flexible sheeting of, for example, canvas or p.v.c. to help protect the goods they carry. Such sheeting is commonly used, for example, in vehicles of the "flatbed" type, where it is spread directly on top of the load, without
10 any separate supporting structure, and secured around its edges to the flat load platform. Flexible sheeting is also frequently used, with a supporting structure, in vehicles of the "curtain-sided" type, or those with a "tilt-top". In the curtain-sided-type vehicle the
15 sheeting forms some part of the substantially vertical sidewalls of a protective enclosure, which extends around and above the load platform. In the tilt-top vehicle the sheeting forms a part of these sidewalls and also the substantially horizontal top of the enclosure.

20 Used in ways such as these, flexible sheeting provides a simple, cheap, lightweight and adaptable protective means which allows easy access to the goods when required. However, although the material can protect goods from the effects of weather and prevents
25 casual inspection, it is little obstacle to a person intent on stealing or damaging them. Such a person may gain access to the goods by, for example, unfastening

the edges of the sheet or cutting through the sheeting material with a knife or other sharp-edged implement. Preventing unauthorised access by either route is difficult, but it is especially difficult to reinforce
5 the sheeting material so as to resist penetration, without incurring a severe penalty in its cost, weight and flexibility.

Unauthorised access to goods which are protected by flexible sheeting is a considerable problem. The
10 impracticality of physically preventing such access has led to the disclosure of alarm systems which warn of attempts to cut through the sheeting material itself. However these systems only work if the flexible sheet is cut, and therefore cannot protect against intrusion by
15 means of unfastening or otherwise deflecting the edges of the sheet, without actually cutting it.

Therefore, an object of the invention is to provide an alarm system which warns of unauthorised attempts to gain access to goods, either around the edges of a
20 flexible protective sheet, or by cutting through the sheet.

Known alarm systems, which warn of attempts to cut through a flexible sheet, employ a network of readily frangible conductors associated with, and extending
25 over, a substantial proportion of the area of the sheet. These conductors are embedded into or otherwise attached to the sheet, so that tearing or cutting the associated portion of sheeting material disrupts them. This

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activates an alarm or other signalling means, by means of suitably - arranged alarm circuitry.

These known systems employ connecting means between the alarm circuitry and the network of conductors which
5 can compromise the inherent adaptability of the flexible protective sheet. For instance, in a curtainsider vehicle, it may be desired to roll the sheeting upwards about a horizontal axis, or to draw the sheeting to the centre or to either side, in order to gain access to the
10 load platform. With known systems, it is necessary to provide separable connectors in order to free all of the edges of the sheet, if such adaptability is to be allowed. Repeated operation of these connectors is inconvenient, especially if situated towards the less
15 accessible upper edges of the sheet.

Therefore a further object of this invention is to provide a means of connecting alarm circuitry to a network of conductors associated with a flexible protective sheet, which does not seriously compromise
20 the ready adaptability of the sheet.

According to this invention an alarm system for deterring unauthorised access to an area protected by flexible closure means, comprises sensing means for association with the closure means and arranged such
25 that, in use, it is operable in response to at least one of the following conditions: disturbance of the closure means, and/or separation of the closure means from a further member or another portion thereof.

Suitably the sensing means includes a first circuit having one or more first conductors for association with the closure means. The sensing means may also include a second conductor for connecting the closure means and the further member or another portion thereof.

Preferably the alarm system is arranged to protect the closure means itself against penetration, and also to prevent the detachment of the closure means from a further member such as the structure of a vehicle. The conductors may be included in a single circuit, but preferably there are two circuits: a first circuit comprising one or more conductors incorporated into or associated with the closure means; and a second circuit comprising one or more conductors connecting the closure means and the further member. Advantageously the conductors of the second circuit extend between an edge region of the closure means and the further member, so as to prevent the edges of the closure means being pulled away from the member.

Disturbance of a conductor preferably involves cutting through it so as to disrupt the current flow through it, but may also involve making a circuit between two such conductors, or deflecting a conductor.

Preferably the conductors of the first circuit are incorporated into a flexible sheet which is attached to the existing flexible sheet as a backing layer. Alternatively they may be attached directly to the existing sheet.

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Advantageously the conductors in the first circuit are connected to alarm circuitry by an extendable conductor, but alternatively there may be a radio link between the circuits.

5 This invention also includes a flexible closure for use in such an alarm system, together with a vehicle incorporating such an alarm system.

This invention will now be described by way of example, with reference to the accompanying drawings, in
10 which:-

Figure 1 is a schematic partial side view of an aspect of an embodiment of the invention;

Figures 2, 3, 4 and 5 are schematic perspective views of this embodiment being used in different ways;

15 Figure 6 is a schematic side view of an embodiment of another aspect of the invention;

Figure 7 is a schematic perspective view of a further embodiment of the aspect shown in Figure 6;

Figure 8 is an enlarged plan view of a detail in
20 Figure 7;

Figure 9 is a schematic perspective view of a further embodiment of the invention.

Figure 10 is a schematic perspective view of an alarm tape in accordance with a further aspect of the
25 invention.

Referring to Figure 1 of the drawings, in an embodiment of the invention a flexible protective sheet 10 extends over substantially the whole area of the side openings

defined by a support structure 12 of a "curtain-sided" goods vehicle. The sheet 10 is of the type conventionally used in this type of vehicle, hanging as a curtain by its upper edge from the structure 12 and
5 being made of, for example, canvas or p.v.c. A similarly-sized inner sheet 14 carries a network 16 of closely-spaced, readily frangible conductors 18 extending over substantially all of its area. The conductors may be impressed into or otherwise
10 attached to the inner sheet 14, which may be made of one or more flexible materials such as p.v.c. or polythene sheeting, or they may be sandwiched between two or more layers of such materials. The inner sheet 14 is attached, for example by adhesive bonding or welding, to
15 the inner surface of sheet 10 so that sheet 10 completely overlays the whole area of inner sheet 14. Therefore, making a cut of significant length anywhere on sheet 10 will also cut the inner sheet 14 and will thus break at least one conductor in the network 16.
20 This breaking of a conductor 18 may activate an alarm in a way to be described below.

Hereinafter, because the inner sheet 14 together with its associated network of conductors 16 behaves as a part of the protective sheet 10 when they are
25 assembled together in use, they shall be referred to together simply as "sheet 10".

Sheet 10 remains affixed, along its upper edge, to the vehicle in everyday use, as shown in Figures 2 to 5

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which illustrate four ways of moving the sheet 10 aside so as to gain access to the load platform. Electrical connection between the network of conductors in sheet 10 and the alarm circuitry mounted on the vehicle (not shown) is accordingly made to this upper edge at point 20, by means of an extendable conductor 22 which connects point 20 to a fixed connection point 24 on the vehicle. This conductor 22 is made extendable by, for example, forming it into the shape of a coil, in which case it may be held conveniently out of the way by suspending it from a wire threaded within the coil. The extendability of conductor 22 means that, if the sheet 10 is slideably displaced to one or other side of the opening, as shown in Figures 2 and 3, the corresponding movement of the connection point 20 relative to the fixed point 24 may be accepted without breaking the connection therebetween. Therefore, although the connection between the sheet 10 and the alarm circuitry may be made readily separable in order to allow convenient removal of the sheet 10 from the vehicle, such separation need not be performed in everyday use, where the sheet 10 remains attached to the vehicle along one edge.

The provision of a network of conductors within the sheet 10 provides a means for sensing cutting of the sheet and thereby activating an alarm. However for full protection, the alarm system also incorporates means which warn of lifting the edges of the sheet 10 away

from the vehicle structure to which it is secured, in an attempt to gain unauthorized access to the protected goods without cutting the sheet. These means take the form of a number of separable connectors 26 disposed
5 around the lower edge and vertical side edges of the sheet 10, as shown in Figure 6, which may be of any convenient type, such as jack-type connectors or magnetic pull-apart cords as sold under the name MAGNAPULL. These connectors are connected into a
10 circuit 28 associated with the sheet 10, which in this embodiment is entirely separate from the network 16 described above but could if desired be integrated with network 16 (it should be noted that sheet 10 incorporates both network 16 and circuit 28, and that
15 network 16 is omitted from Figures 6 and 7 only for clarity). Pulling the edges of the sheet 10 away from the vehicle separates the connectors and thus involves breaking a circuit, which can activate an alarm. The mounting points of the connectors 26 on the curtain and
20 vehicle are advantageously designed so that if they are dismantled, an alarm sounds due to the breaking of a circuit.

Some manufacturers are now producing curtain-sided vehicles without buckles arranged along the lower edge
25 of the curtain, in which case connectors 26 may suitably be located at each end of the curtain, either at the base of the curtain, at the top and at the base, or at the top, the base and at points in between.

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Referring now to Figure 7, an alternative arrangement of this second aspect of the invention incorporates separable connectors 26 along the lower edge of a sheet 10 connected by a circuit 28, as before.

5 However the vertical edges of the sheet 10 are protected by vertical poles 30 which each locate at their respective ends into an upper slot 32 and a lower slot 34, the lower slot incorporating a microswitch which detects removal of the pole therefrom. These poles are

10 located, as far as possible, at the extreme side ends of the side openings 36 of a goods vehicle, so as not to affect the utility of the load platform. The inner sheet 14, carrying the network 16 as previously referred to, may be conveniently fixed to a pole 30 by wrapping

15 it around the pole to form a pocket as shown in Figure 8. This allows the pole 30 to be readily slid in and out of this pocket when the sheet 10 needs to be moved, while preventing significant movement of this edge of the sheet without moving the pole from its mounting

20 slots (thereby activating the alarm by means of the microswitch). The inner sheet 14 is separate from the "outer" sheet 10 at each end so as to allow the outer sheet to be fixed to its pole 38 in the usual manner. Conveniently, the microswitches in slots 34 are

25 connected into the circuit 28 so as to simplify the wiring required.

An alternative arrangement of this embodiment instead provides microswitched slots for the "outer"

poles 38, with the sheet 10, including inner sheet 14, being wrapped around the poles 38, thereby removing the need for "inner" poles 30 in order to sense lifting of these edges of the sheet.

5 A further arrangement for preventing access around the edges of the sheet 10 is shown in Figure 9, where a number of eyelets 40 are disposed around the edges of the side openings 36 on the vehicle structure 12. These protrude through slots 42 provided in the sheet 10, when
10 the sheet is extended across the opening 36. A flexible conductor 44 is threaded through these eyelets and connected at each end 46 into an alarm circuit, thereby securing the sheet 10 to the structure 12. Thus the sheet can only be lifted by cutting the conductor 44 or
15 by disconnecting its ends, which can be made to activate an alarm.

The edges of the sheet may also be secured by other means such as a zip fastener, incorporating means such as connectors which are separable in response to the
20 opening of the zip, thereby activating an alarm. This broad principle can be applied to a variety of enclosures incorporating a fastener such as a zip or a lace across an opening, for example tents, boat covers or car covers. Suitably there are conductor running
25 through the enclosure, together with separable conductor for extending across the opening.

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The alarm systems described so far may be activated in response to cutting a conductor, or otherwise breaking a connection, so as to break a first electrical circuit of which the conductor or connection is a part.

5 Such an electrical circuit includes an electricity supply such as a battery, an electromagnetic relay or solenoid, the conductor (for example the network 16 or pull-apart cords 26) and means which electrically connect these components. The relay directly or

10 indirectly controls a switch in a second alarm circuit, this second circuit including an alarm which is activated when the switch is closed. Thus the relay (and its associated switch) are held open while the first circuit is complete, but if the first circuit is

15 broken by the breaking of a conductor or a connection, the relay closes the switch in the second circuit, thereby sounding the alarm.

Means may also be provided to activate the alarm in response to a significant fluctuation in the current

20 flowing in the first circuit or in the voltage drop across the conductor, so that a complete break in the first circuit need not be required to activate the alarm. In particular the changing conductive characteristics of the conductors as the sheet is flexed

25 could be used to activate the alarm.

For the fullest possible protection, it is envisaged that the various alarm circuits used in any one application of the invention are connected into and

monitored by a control box. The control box may be situated in any secure and convenient place and be connected to the alarm circuits by any convenient means, including where necessary a radio link or other transmitting/receiving device. Such a box could if necessary monitor and control several alarm systems at one, thereby guarding a number of lorries at once, for example. Alternatively the box can be mounted directly to the vehicle or article it protects, for instance mounted to an inner corner of the load platform adjacent the front bulkhead of a curtainsider vehicle. In this case the box can have inputs from each side curtains to warn of attempts to cut through or otherwise disturb the sheeting, as described, together with inputs from sensors which warn of, for example, attempts to force the rear doors, cut through the steel roof or move the entire vehicle. Two sirens, one outside on the front bulkhead, another inside on the steel roof structure, frustrate attempts to put the alarm system out of action. The system could further include paging means to alert the driver or the police directly if an attempt is made to gain access. In similar fashion provision can be made for the system to emit homing signals in the event of the vehicle being stolen, so that the vehicle can be readily located by picking up those signals on a suitable receiver.

Many further variations, both of the alarm system itself and the use to which it is put, are possible.

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For example the flexible sheet may itself include the necessary conductors of the alarm system. In one such arrangement the network of conductors 16 may be made up of individual alarm tapes attached to the inner face of the flexible sheet. Figure 10 shows an alarm tape 48 in accordance with a further aspect of this invention, comprising a backing strip 50 of pvc or other suitable flexible material, which is preferably reinforced by laminating it with, for example, strands of nylon material as shown. Preferably the strip 50 is about 32mm wide by about 0.30mm thick, although its dimensions can be chosen to suit any particular application. Extending along, and attached to, the central portion of one side of the tape 48 are two insulated conductors 52 which lie substantially parallel to and separate from one another. Each conductor preferably comprises four ends of twisted copper tinsel thread wrapped around a thread of polyester or cotton, although two or more ends or other suitable materials, could be employed if desired. The conductors 52 may be attached to the backing strip 50 by any suitable means such as fusion, bonding or laminating, while there need not be two conductors but any number considered desirable.

In use, tape 48 is bonded, welded, stitched or otherwise attached to the inner face of a flexible sheet, with the conductors 52 facing the sheet and with the points of attachment extending along the backing strip

50 on either side of the conductors, such that the conductors are shrouded in a pocket between the backing strip and the flexible sheet. Suitable lengths of tape 48 can be arranged and attached to the sheet so as to
5 build up a network of conductors as desired. The conductors associated with the various lengths of tape can be connected together to include them within an electrical circuit.

The conductors need not be in the form of wires,
10 but could take the form of a foil strip, a conductive coating deposited on a strip of, for example, p.v.c. or polythene, or any other material which conducts an electric current or impulse. Optical fibres may be used, together with suitable light-generating and
15 sensing means. The conductors or fibres used in the network may be incorporated into the weave of the sheet they protect, where appropriate.

The alarm could alternatively be operable in response to the making of a circuit, for example between
20 two separate conductive membranes incorporated as layers within a flexible sheet, the connection between being made when the sheet is cut. This connection could be through a metallic knife blade which is being used to cut the sheet, or could arise from deformation of the
25 membranes into contact with one another, as a result of the cutting action. The membranes could be made up of sheeting material coated with a conductive substance and could be separated in normal use by an inner sheet or

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any other suitable separating/insulating means.

The advantages given by the extendable conductor 22 may also be realised by replacing it with a radio link or other transmitting/receiving means. Such a link
5 could comprise a transmitter on the curtain and a receiver on the vehicle, the transmitter being operable in response to the curtain being disturbed, thereby activating an alarm by means of circuitry associated with the receiver. No electrically conductive link need
10 be provided in this case between curtain and vehicle if the transmitter and its circuitry are battery powered.

It will be clear to a person skilled in the art that many combinations of the aforementioned sensing means may be used as the basis of an efficient alarm
15 system.

Although in preferred arrangements, conductors extend across the closure means to detect disturbance thereof, this could alternatively be sensed by sensor means adapted to detect the sound of tearing or cutting
20 the closure means. Also along the edge of the closure means, although it is preferred to have a physical connection, sensing separations could involve breaking a light beam or similar beam.

Although this invention has been described
25 principally in relation to a curtainsider-type vehicle, it will be clear that it is equally suited to use on flatbed, tilt-top or other forms of vehicle. Indeed it can be applied to almost any situation where a

protective sheet of flexible material such as cotton,
p.v.c., nylon or polythene is used to enclose valuable
items, such as in soft-top car hoods, construction
sites, tents, marquees, camping equipment, awnings,
5 blinds, and covers for articles such as boats, cars,
trailers, skis, surf boards and theatrical equipment.

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CLAIMS

1. An alarm system for deterring unauthorised access to an area protected by flexible closure means, comprising sensing means for association with the closure means; and
5 arranged such that, in use, it is operable in response to at least one of the following conditions: disturbance of the closure means, and/or separation of the closure means from a further member, or another portion thereof.
2. An alarm system according to Claim 1 wherein said
10 sensing means includes a first circuit having one or more conductors for association with the closure means.
3. An alarm system according to Claim 2, wherein said sensing means includes a second conductor for connecting the closure means and the further member or another
15 portion thereof.
4. An alarm system according to Claim 3, wherein the first and second conductors are a part of first and circuits respectively.
5. An alarm system according to Claim 2, wherein
20 the first circuit is connected to alarm circuitry by an extendable conductor.
6. An alarm system according to Claim 2, wherein the first circuit is connected to alarm circuitry by transmitting/receiving means.
- 25 7. An alarm system according to Claim 5 wherein the transmitting/receiving means is a radio link.
8. An alarm system according to any preceding claim wherein the first circuit comprises a plurality of

conductive membranes which come into conductive contact with each other if the closure means is penetrated, thereby activating an alarm.

9. An alarm system according to any preceding claim
5 wherein the sensing means is added to the closure means.

10. An alarm system according to Claim 9, wherein the sensing means is a first conductor incorporated into a tape which is attached to the closure means.

10 11. An alarm system according to any preceding Claims wherein the sensing means comprises conductors associated with a separate sheet which is included with the closure means.

12. An alarm system according to Claim 11, wherein a
15 conductor is an electrical conductor.

13. An alarm system for deterring unauthorised access to an area protected by flexible closure means, comprising a first circuit having one or more conductors included with the closure means and a second circuit
20 having one or more conductors for connecting the closure means to a further member, the alarm, in use, being operable in response to at least one of the following conditions: disturbance of the closure means, by disturbance of a conductor in the first circuit; and
25 separation of the closure means from the further member, by breaking a conductor in the second circuit.

14. An alarm system according to Claim 13, wherein the flexible closure means includes a sheet for protecting

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the load area of a vehicle, the second circuit comprises an array of separable conductors disposed about edge regions of the sheet for connecting it to the vehicle's structure.

5 15. An alarm system according to Claim 13, wherein one or more sides of the sheet are attached to the vehicle by means of poles which locate into attachment points on the vehicle, the attachment points having sensors for detecting removal of the pole therefrom and thereby
10 activating an alarm when appropriate.

16. An alarm system according to Claim 15 wherein the sensors are incorporated into the second circuit.

17. A closure for use in an alarm system, comprising a flexible sheet, a first conductor means associated with
15 the sheet for connection in an alarm circuit for sensing disturbance of the sheet, and a second conductor means for connection in an alarm circuit for sensing separation of the sheet from a further member or another portion thereof.

20 18. A closure according to Claim 17, wherein the first conductor means comprises a separate circuit of conductors added to the sheet.

19. A vehicle having a load platform at least partially enclosed by flexible closure means, including an alarm
25 system for deterring unauthorised access to the load platform by disturbance of the flexible closure means, wherein the alarm system comprises a first sensing means associated with the closure means, for connection in an

alarm circuit for sensing disturbance of the closure means, and a second sensing means for connection in an alarm circuit for sensing separation of the closure means for the vehicle.

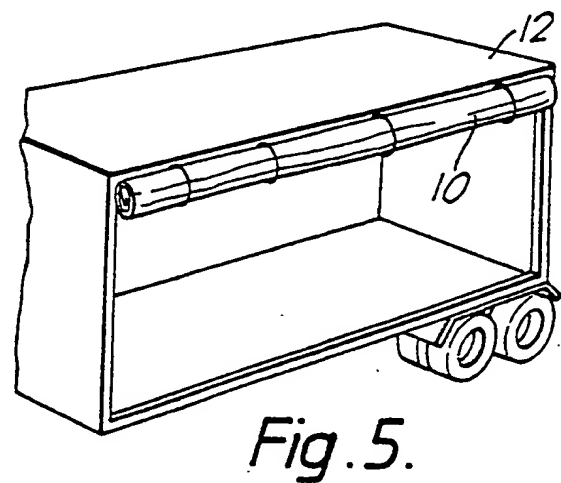
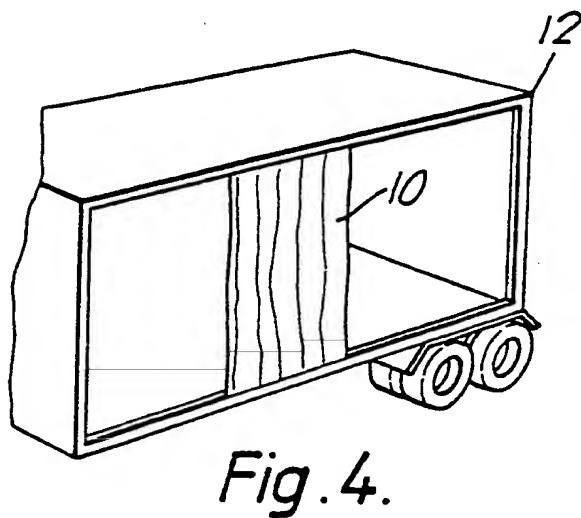
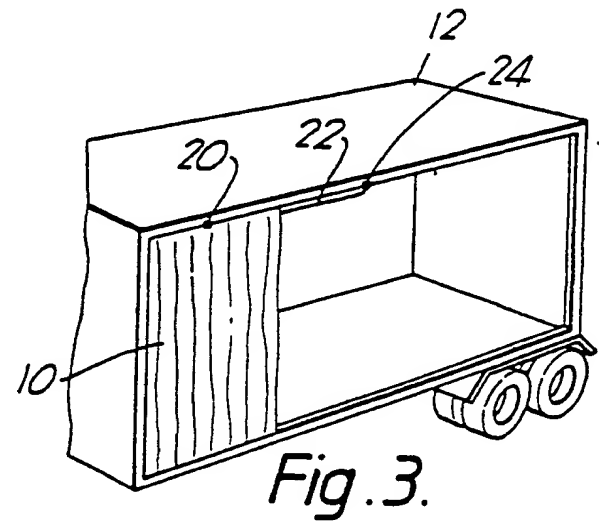
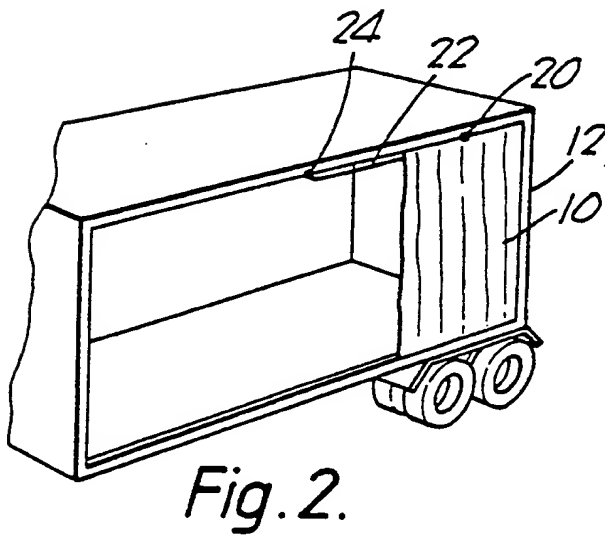
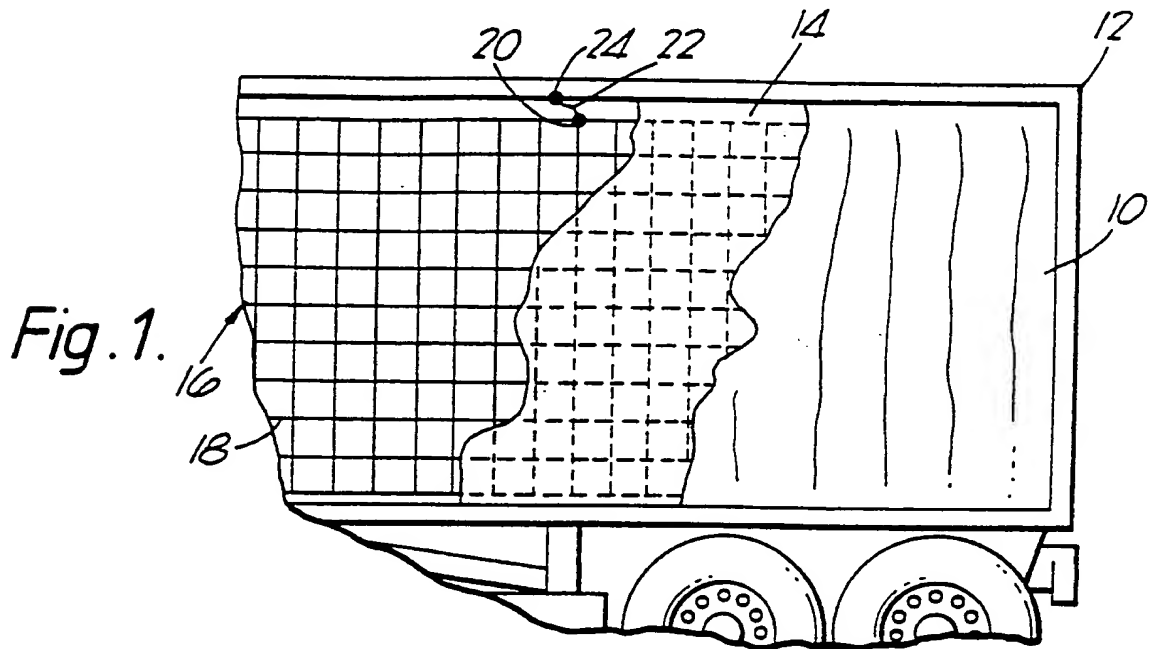
5 20. A vehicle according to Claim 19, wherein the first sensing means includes a first conductor and comprises part of a first circuit and is operable upon penetrating the flexible closure means.

21. A vehicle according to Claim 19 or 20, wherein the
10 second sensing means includes a second conductor and comprises part of a second circuit protecting along the edge of the flexible closure means and is operable upon separation of the closure means from the structure of the vehicle.

15 22. An alarm tape for use in an alarm system for deterring unauthorised access to an area protected by flexible closure means, comprising a conductor and a supporting strip, wherein the tape, in use, may be attached to the flexible closure means.

20 23. An alarm tape according to Claim 16, wherein in use, attached to the closure means, the supporting strip cooperates with the closure means to enshroud the conductor.

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Fig. 6.

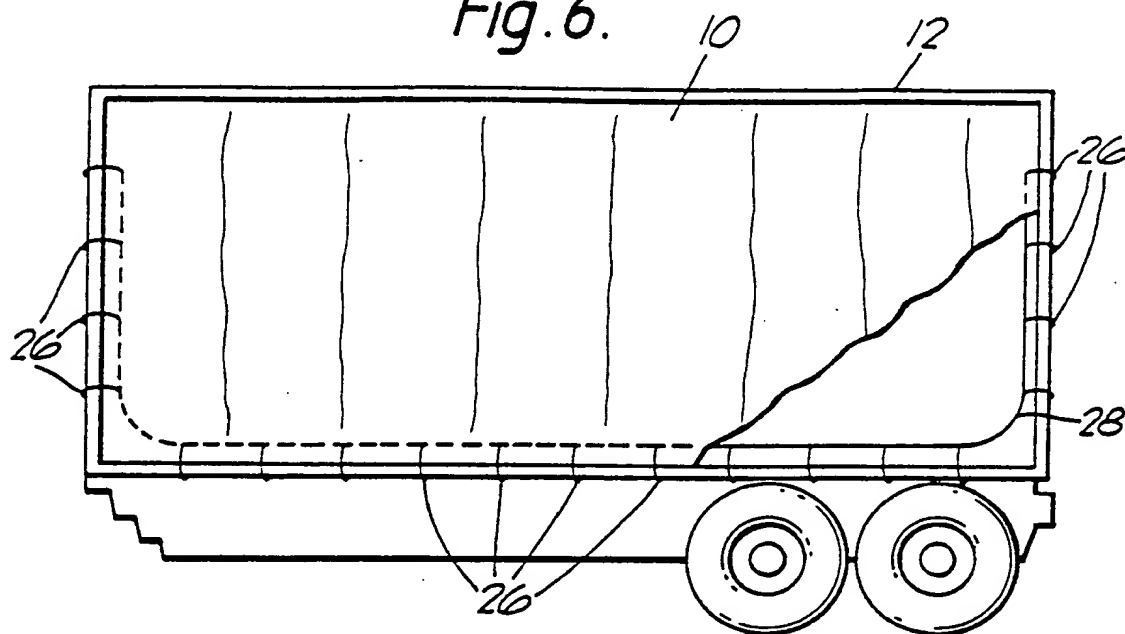


Fig. 7.

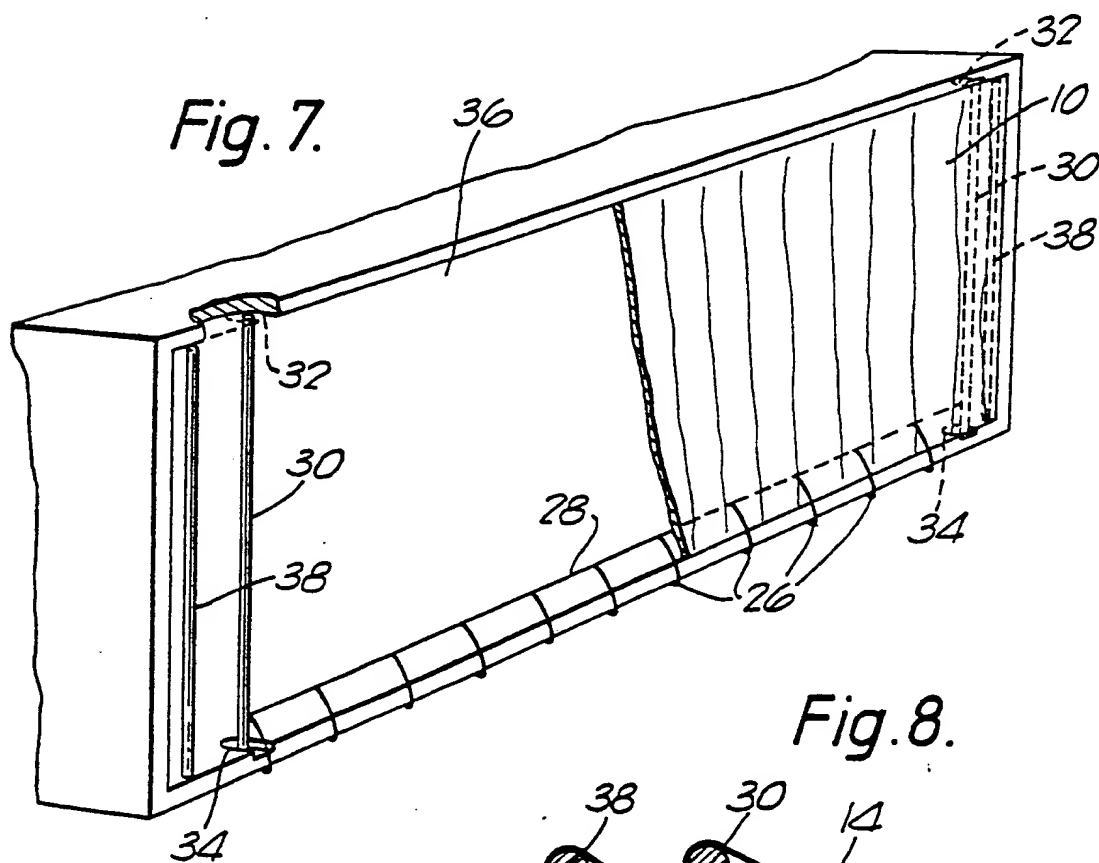
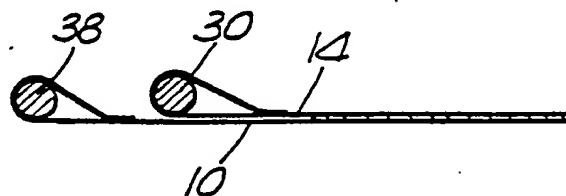


Fig. 8.



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Fig. 9.

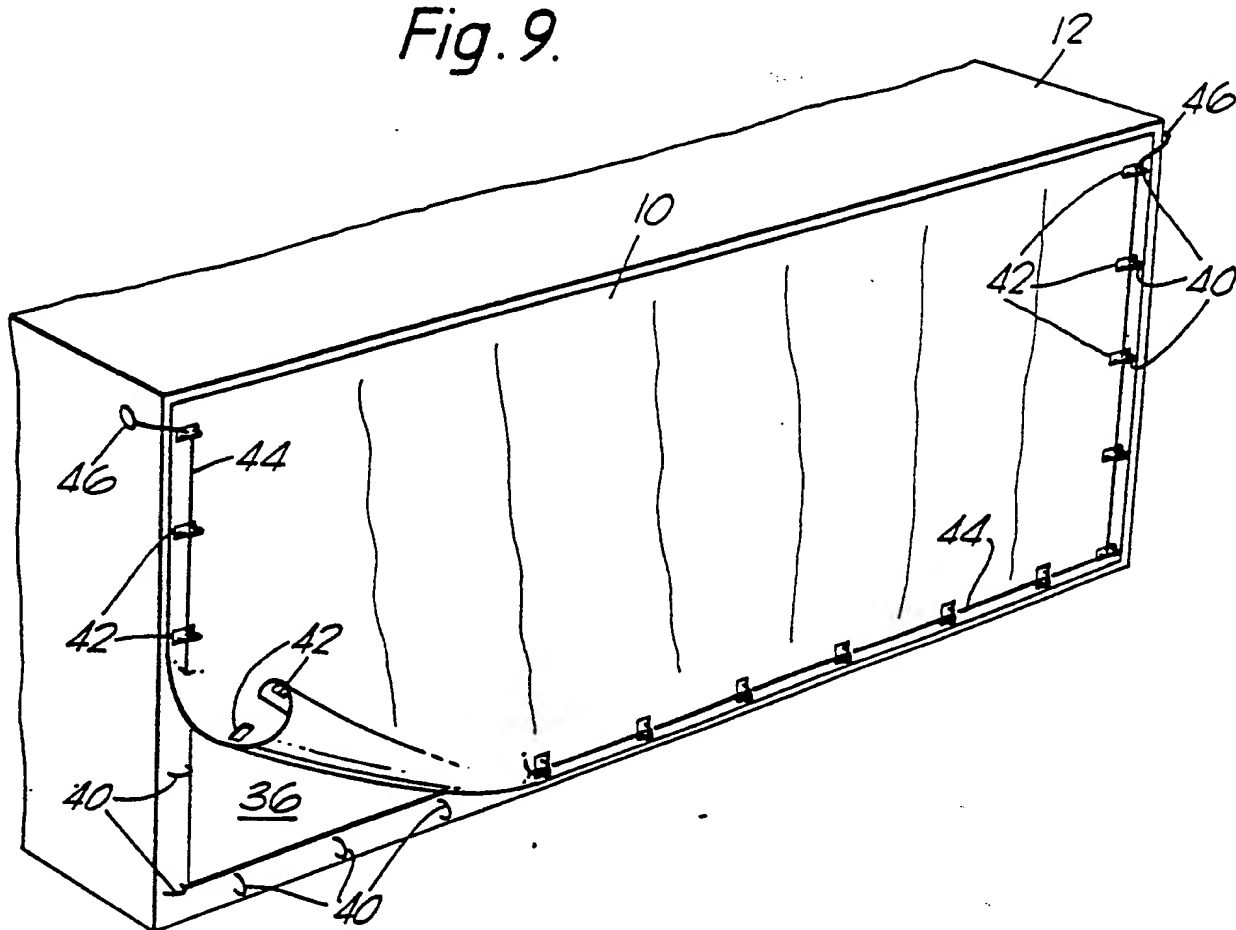
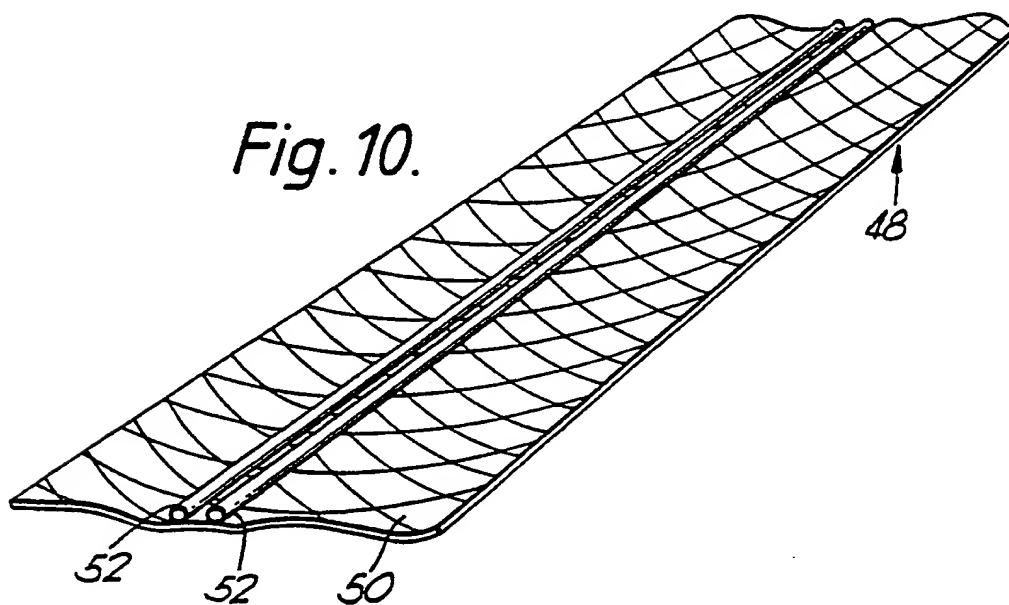


Fig. 10.



INTERNATIONAL SEARCH REPORT

International Application No PCT/GB 87/00289

I. CLASSIFICATION OF SUBJECT MATTER (if several classification symbols apply, indicate all) *

According to International Patent Classification (IPC) or to both National Classification and IPC

IPC⁴: G 08 B 13/12

II. FIELDS SEARCHED

Minimum Documentation Searched *

Classification System

Classification Symbols

IPC⁴

G 08 B; B 60 R

Documentation Searched other than Minimum Documentation
to the Extent that such Documents are Included in the Fields Searched *

III. DOCUMENTS CONSIDERED TO BE RELEVANT *

Category *	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³
X	DE, A, 2441054 (RUSHING) 18 March 1976 see the whole document	1-5, 9, 11-14, 17-21
Y	--	6-8, 10, 22, 23
A	DE, A, 2441053 (RUSHING) 18 March 1976 see the whole document	1-5, 11-14, 19 -21
Y	--	8
Y	DE, A, 3246061 (KREUZER) 14 June 1984 see claims 1-3	6, 7
Y	--	10, 22, 23
Y	US, A, 3668675 (JOENS et al.) 6 June 1972 see abstract	1, 2, 5, 9, 11, 12
Y	--	
X	NL, A, 8302098 (STUART STUART-HOWIE) 2 January 1985 see claim 6	
X	--	
X	FR, A, 2385880 (ALTEN) 27 October 1978 see the whole document	

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IV. CERTIFICATION

Date of the Actual Completion of the International Search

24th August 1987

Date of Mailing of this International Search Report

24 SEP 1987

International Searching Authority

EUROPEAN PATENT OFFICE

Signature of Authorized Officer

L. ROSSI

INTERNATIONAL APPLICATION NO.

PCT/GB 87/00289 (SA 17074)

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Anmelder/Applicant/Demandeur/Patentinhaber/Proprietor/Titulaire Hi-G-Tek Ltd	

COMMUNICATION

The European Patent Office herewith transmits as an enclosure the European search report for the above-mentioned European patent application.

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The following figure will be published together with the abstract: 1

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If applicable under Article 10 Rules relating to fees, a separate communication from the Receiving Section on the refund of the search fee will be sent later.





European Patent
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EUROPEAN SEARCH REPORT

Application Number
EP 99 20 2821

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Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
A	WO 87 06749 A (WOLF ADRIAN FRANCIS) 5 November 1987 (1987-11-05) * page 5, line 26 - page 6, line 21; figures *	1	B60R25/10 G08B13/12
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			B60R G08B
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 10 January 2000	Examiner Areal Calama, A-A
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